



Survey of Gastrointestinal Parasites of Non-Human Primates in Jos Zoological Garden

Dawet A*, Yakubu DP and Butu HM

Department of Zoology, University of Jos, Jos, Nigeria

Abstract

Non-human primates (NHP) serve as important reservoirs of parasites that cause diseases to man as close interactions between humans and NHP create pathways for the transmission of zoonotic diseases. The aim of this study was to carry out a survey of the intestinal parasites of NHP in Jos Zoological garden. Stool samples were collected from thirty one (31) NHP and examined using direct wet mount, floatation and sedimentation methods. Of this, helminths and protozoa were recorded. *Trichuris trichiura* recorded the highest (58.06%) prevalence of the helminths, followed by hookworm and *Ascaris lumbricoides* which recorded prevalences of 38.71% and 19.35 % respectively. For the protozoan parasites recovered, *Entamoeba coli* was the most prevalent (93.55%) followed by *Entamoeba histolytica/nuttali* (74.19%), while *Cyclospora* spp recorded the least prevalence (12.90%). Among the NHP observed, baboons, chimpanzees and patas monkeys were infected at different levels with all the three helminths recorded while Mona and tantalus monkeys were only infected with *T. trichiura* and hookworm. The entire protozoans recorded were found in baboon and Tantalus monkeys while chimpanzees, mona and patas monkeys were infected with *E. coli* and *E. histolytica/nuttali*. Regular parasitological examination and treatment of NHP should be carried out to prevent zoonotic infection of zoo keepers and park visitors.

Keywords: Intestinal parasites; NHP; Zoological garden; Jos

Introduction

Zoological parks have evolved from being menageries to educational as a means of promoting knowledge not only of the animals in collection, but also of the ecosystem conservation and preservation. NHP represent one of the most interesting groups of zoo animals maintained in captivity for their valuable role in public entertainment [1].

Zoo animals welfare remains a challenging area, as increasing demands are placed on zoos and regulatory agencies to manage this diminishing resources [2]. The goal of an occupational health program is to ensure a safe and healthy working environment for the employers, who then have the responsibility of providing a safe and healthy environment for the animals in their care [3].

Zoo animals often come in contact with humans from the zoo keepers and game rangers tending them to park visitors and people who keep them as pets. NHP are susceptible to many biological agents that infect human beings [4] reported that *Trichuris* and *Oesophagostomum*, and *Trichuris* and *Entamoeba* were the most frequently encountered parasites in Agodi zoo and University of Ibadan (UI) zoo respectively. However, *Balantidium* and *Enterobius*, and *Giardia* infections in the gorillas and chimpanzees respectively at the Agodi and UI zoos were thought to be of human origin because the same animals had never escaped from captivity. This thought was confirmed in another study by [5] who reported the presence of both helminths (*Ascaris lumbricoides*, hookworms and *Trichuris trichiura*) and protozoa (*Entamoeba histolytica* and *Giardia lamblia*) among zoological garden workers while only helminths (*Strongyloides* spp, *Trichuris* spp and *Ascaris* spp) were found in zoo animals and birds in the UI zoological garden. In a study carried out on primate bush meat and pets in Cameroon, seven nematode species, three protozoan species, one trematode species and one cestode species were reported [6]. Eight different parasites were found in *Cercopithecus nictitans* and six in *C. neglectus*, *C. pogonias* and *Cercocebus agilis*. Helminths were found in 77% monkeys, and protozoa in 36%. Among the helminthes species, *Strongyloides fuelleborni* was more prevalent in bush meat monkeys than in pets (55% versus 15%).

Similarly, seven species of helminths and three species of protozoa in chimpanzees (*Pan troglodytes*), and seven species of helminths, two species of trematodes and one species of protozoa in baboons (*Papio cynocephalus anubis*) were reported in Gombe National Park [7]. However, trematodes and cestodes were not detected in among NHP in four zoological gardens in Belgium [8]. The most prevalent parasites recorded were *Entamoeba* spp 59% and *Giardia* spp 41% while *Iodamoeba butschlii* and *Strongyloides* spp had (5%) each.

This survey was carried out to identify the prevalence of gastrointestinal parasites in NHP in Jos zoological garden in order to provide up to date information on NHP.

Materials and Methods

Study area

The study was conducted in Jos, Plateau State, Nigeria. Plateau State is located in the Northern Guinea Savanna vegetation belt, covering 8600 km² with an average altitude of 1280 m. It lies between latitude 9°55'07" N and longitude 8°53'54" E. The climate is semi-temperate with temperatures ranging from 18°C (64.4°F) to 25°C (77.0°F). The city of Jos receives about 1400 mm (55.1 in) of rainfall annually (http://en.wikipedia.org/wiki/Jos_Plateau). The Jos zoological garden houses numerous animals from the primates in this study to carnivores, ungulates, birds and reptiles. The NHP available in the garden were used for the study. The garden demarcated is fenced to prevent free

*Corresponding author: Dawet A, Department of Zoology, University of Jos, Jos, Nigeria, E-mail: dawetanthony@yahoo.com

Received February 09, 2013; Accepted March 11, 2013; Published March 14, 2013

Citation: Dawet A, Yakubu DP, Butu HM (2013) Survey of Gastrointestinal Parasites of Non-Human Primates in Jos Zoological Garden. J Primatol 2: 108. doi:10.4172/2167-6801.1000108

Copyright: © 2013 Dawet A, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

movement in and out of the premises. Each species of the animals were kept separately in a large area where they free movement.

Collection of samples

Samples were collected as described by [9]. Samples were collected between 7-9 am in June to September, 2011. 31 individually identified primates were followed in their home ranges and top layer of fresh sample was scooped immediately after defaecation and then each sample was put in a labelled sterile bottle and kept in a cooler prior to transportation to the laboratory where they were immediately examined within 4-5 hours.

Examination of samples

Samples obtained were examined using the methods as described [10].

Direct wet smear

Wet faecal mounts with and without staining with Lugol's iodine was used to check for the presence of protozoa. One gram of the faecal sample was transferred with an applicator stick unto a grease free slide. A drop of normal saline was then added and emulsified and covers with a clean cover slip. To another slide containing one gram of the faecal sample, a drop of Lugol's iodine was added and viewed under the microscope using 10x and 40x objectives. Trophozoites and cysts/eggs were identified based on microscopic morphology.

Simple test tube floatation

One gram of sample was put into a beaker containing 50 ml floatation fluid and stirred thoroughly. The resulting suspension was filtered into labelled test tubes arranged in a rack. The test tubes were gently filled with the suspension leaving a convex meniscus on the top of the tube and a cover slip was carefully placed on top of the test tube and allowed to stand for 20 minutes. The cover slip was carefully lifted and immediately placed on a clean microscope slide and examined under the microscope at 10x and 40x objectives for helminths ova.

Sedimentation method

The sample was added to the normal saline solution, mixed, then washed and filtered through sieve into another beaker. The filter solution was poured into centrifuge tubes and centrifuged for 5 minutes at 1500 revolution per minute using a centrifuge. The supernatant was decanted. One or two drop of the sediment was placed on microscope slide and viewed under a light microscope for identification of ova of helminths and adult helminths respectively. Helminths were identified using the key provided [10,11].

Statistical analysis

Data were analyzed using Chi square (χ^2) methods. Values at $P < 0.05$ were considered significant.

Results

The survey showed that the primates were infected with helminth and protozoa parasites. Among the helminthes, *Trichuris trichiura* had the highest (58.06%) prevalence, followed by hookworm (38.71%) and *Ascaris lumbricoides* (19.35%). However, the prevalence helminth species was not significantly ($P > 0.05$) different among the NHP (Table 1). Of the protozoa, *Entamoeba coli* had the highest (93.55%) prevalence, followed by *Entamoeba histolytica/nuttali* and *Cyclospora* spp which had 74.19% and 12.90% respectively. Analysis showed

a significant ($P < 0.05$) difference in the prevalence rate of protozoa species (Table 2).

The prevalence of helminths according to type of primates is shown in table 3. Hookworm had the highest (57.14%) prevalence in baboons while *T. trichiura* had the highest prevalence in chimpanzees (60%), mona monkeys (66.67%), patas monkeys (57.14%) and tantalus monkeys (66.67%). However, while *A. lumbricoides* had the lowest prevalences in baboons (42.86%), chimpanzees (20%) and patas monkeys (28.57%), it was not recorded in mona monkeys and tantalus monkeys. The prevalence of protozoa in the difference primates is shown in table 4. *E. coli* had 100% prevalence in all the primates except chimpanzees which had 60% infection rate. *Cyclospora* spp was recorded only in baboons and tantalus monkeys which had 28.57% and 22.22% prevalence respectively.

The overall prevalence of gastrointestinal parasites showed that baboons were parasitized by all the parasites recorded in this study. Chimpanzees, patas monkeys and tantalus monkeys had five parasites species each while monas monkeys had four parasites species (Table 5).

Discussion

The presence of parasites in all primate species indicates that animals kept in zoological gardens are at risk of infection by various gastrointestinal parasites. The infection by helminths and protozoa reported in this study is consistent with [8,12,13]. However, in addition

Helminths	Number examined	Number infected	Percent infected
Hookworm	31	12	38.71
<i>A. lumbricoides</i>	31	6	19.35
<i>T. trichiura</i>	31	18	58.06

χ^2 calculated=4.421, χ^2 tabulated at df 2=5.991, $P > 0.05$

Table 1: Prevalence of helminths among NHP.

Helminths	Number examined	Number infected	Percent infected
<i>Cyclospora</i> spp	31	4	12.90
<i>E. coli</i>	31	29	93.55
<i>E. histolytica/nuttali</i>	31	23	74.19

χ^2 calculated=13.710, χ^2 tabulated at df 2= 5.991, $P < 0.05$

Table 2: Prevalence of protozoa among NHP.

Animal	Number examined	Number (%) infected		
		Hookworm	<i>A. lumbricoides</i>	<i>T. trichiura</i>
Baboons	7	4 (57.14)	7 (100)	5 (71.43)
Chimpanzees	5	2 (40)	1 (20)	3 (60)
Mona monkeys	3	1 (33.33)	00	2 (66.67)
Patas Monkeys	7	1 (14.29)	2 (28.57)	4 (57.14)
Tantulus monkeys	9	4 (44.44)	00	6 (66.67)
Total	31	12 (38.71)	6 (19.35)	18 (58.06)

Table 3: Prevalence of helminths in relation to types of NHP.

Animal	Number examined	Number (%) infected		
		<i>Cyclosporai</i> spp	<i>E. coli</i>	<i>E. histolytica/nuttali</i>
Baboons	7	2 (28.57)	7 (100)	5 (71.43)
Chimpanzees	5	00	3 (60)	3 (60)
Mona monkeys	3	00	3 (100)	2 (66.67)
Patas Monkeys	7	00	7 (100)	6 (85.71)
Tantulus monkeys	9	2 (22.22)	9 (100)	7 (77.78)
Total	31	4 (12.90)	29(93.55)	23 (74.1)

Table 4: Prevalence of protozoa in relation to types of NHP.

Parasites	Overall Prevalence of Animals				
	Baboons (n=7)	Chimpanzees (n=5)	Mona monkeys (n=3)	Patas monkeys (n=7)	Tantalus monkeys (n=9)
<i>Hookworm</i>	4 (57.14)	2 (40)	1 (33.33)	1 (14.29)	4 (44.44)
<i>A.lumbricoides</i>	3 (42.86)	1 (20)	00	2 (28.57)	00
<i>T.trichiura</i>	3 (42.86)	3 (60)	2 (66.67)	4 (57.14)	6 (66.67)
<i>Cyclospora</i> spp	2 (28.57)	00	00	00	2 (22.22)
<i>E.coli</i>	7 (100)	3 (60)	3 (100)	7 (100)	9 (100)
<i>E.histolytica/nuttali</i>	5 (71.43)	3 (60)	2 (66.67)	6 (85.71)	7 (77.78)

Table 5: Overall prevalence of gastrointestinal parasites in relation to the types of NHP.

to helminths and protozoa, the prevalence of trematodes and cestodes species was reported [6]. The high infection of primates by protozoa than helminthes observed in this study is in accord with [14] who reported six protozoa and four helminths parasites of owl monkeys. The high prevalence of protozoa reported in this study is at variance with [5,6,15,16] who separately reported that helminths are the dominant gastrointestinal parasites of primate in zoological gardens. The high prevalence of protozoa recorded in this study could probably be due to the climatic factors which provide optimal condition for the viability of parasite eggs and ova. Similarly, deworming of these NHP few days before the beginning of the study could probably reduce the prevalence of helminths infection.

T. trichiura and *E. coli* which were the most frequent parasites reported in this study is in agreement with [6]. However, this varies with [5,14,17] who reported that *Strongyloides* spp was the most prevalent helminths. This may be due to frequent interactions between infected and uninfected since transmission is by contamination.

The infection of baboons with more parasites species than other primates is consistent with [7] who reported more parasites in baboons than chimpanzees. On the contrary, high prevalence of intestinal parasites among gorillas and chimpanzees was reported. Also, it was reported that mona monkeys had the highest ova and oocyst counts and variety of gastrointestinal parasites followed by white-collared mangabey and chimpanzees (*Pan troglodytes*) [18]. Similarly, several species of protozoa have been identified in captive primates [19]. In another study, the presence of *Oesophagostomum* spp in stump-tailed macaque was reported while golden langur and hoolock gibbon were found positive for the presence of *Trichuris* spp [20]. The variation according to species could be attributed to the differences in immune responses to the infections.

In conclusion, this finding showed that primates in the Jos zoological gardens were infected with helminths and protozoa parasites which are zoonotic. There is need for proper environmental control and management of the gardens, frequent treatment and prevention of zoo workers and animals to avoid further contaminations. The public should be enlightened about the need for the maintenance of standard hygiene within the gardens to prevent zoonotic infections.

References

1. Agoramoorthy G, Hsu MJ (2005) Use of nonhuman primates in entertainment in Southeast Asia. J Appl Anim Welf Sci 8: 141-149.
2. Kohn B (1994) Zoo animal welfare. Rev Sci Tech 13: 233-245.
3. Robert JA (1995) Occupation health concerns with non human primates in zoological gardens. J Zoo Wildl Med 26: 10-23.
4. Ajayi JA (1984) Infection of human origin in zoo animals in Ibadan, Nigeria. Bull Anim Hlth Prod Afri 32: 107-109.
5. Akinboye DO, Ogunfemi AA, Fawole O, Agbolade O, Ayinde OO, et.al (2010) Control of parasitic infections among workers and inmates in a Nigerian zoo. Nigerian Journal of Parasitology 31: 35-38.
6. Pourrut X, Diffo JL, Somo RM, Bilong Bilong CF, Delaporte E, et al. (2011) Prevalence of gastrointestinal parasites in primate bushmeat and pets in Cameroon. Vet Parasitol 175: 187-191.
7. Murray S, Stem C, Boudreau B, Goodall J (2000) Intestinal parasites of baboons (*Papio cynocephalus anubis*) and chimpanzees (*Pan troglodytes*) in Gombe National Park. J Zoo Wildl Med 31: 176-178.
8. Levecke B, Dorny P, Geurden T, Vercammen F, Vercruysse J (2007) Gastrointestinal protozoa in non-human primates of four zoological gardens in Belgium. Vet Parasitol 148: 236-246.
9. Ekanayake DK, Arulnathan A, Horadagoda NU, Sanjeevani GK, Kieft R, et al. (2006) Prevalence of cryptosporidium and other enteric parasites among wild non-human primates in Polonnaruwa, Sri Lanka. Am J Trop Med Hyg 74: 322-329.
10. Cheesebrough M (2005) Medical laboratory manuals for tropical countries, microbiology and parasitology. Cambridge University Press 209-235.
11. Food and Agricultural Organisation (2010) Techniques for parasite assays and identification in faecal samples. Corporate document reposition.
12. Munene E, Otsyula M, Mbaabu DA, Mutahi WT, Muriuki SM, et al. (1998) Helminth and protozoan gastrointestinal tract parasites in captive and wild-trapped African non-human primates. Vet Parasitol 78: 195-201.
13. Opara MN, Osuji CT, Opara JA (2010) Gastrointestinal parasitism in captive animals at the zoological garden, Nekede Owerri, Southeast Nigeria. Report and Opinion 2: 21-28.
14. Perea-Rodriguez, JP, Milano AM, Oshero BE, Fernandez-Duque E (2010) Gastrointestinal parasites of owl monkeys *Aotus azarai azarai* in the Argentinean chaco. Neotropical Primates 17: 7-11.
15. Mbora DN, Munene E (2006) Gastrointestinal parasites of critically endangered primates endemic to Tana River, Kenya: Tana River red colobus (*Procolobus rufomitratus*) and crested mangabey (*Cercocebus galeritus*). J Parasitol 92: 928-932.
16. Kio K (2011) A case study for survey of gastrointestinal parasites of sykes monkeys (*Cercopithecus mitis albogularis*) at Gede ruins national monuments forest, coast province, Kenya.
17. Lilly AA, Mehlman PT, Doran D (2002) Intestinal parasites in gorillas, chimpanzees and humans at Mondika Research site, Dzanga-Ndoki National Park, Central African Republic. Int J Primatol 23: 555-573.
18. Mbaya AW, Udendeye UJ (2011) Gastrointestinal parasites of captive and free-roaming primates at the Afi Mountain Primate Conservation Area in Calabar, Nigeria and their zoonotic implications. Pak J Biol Sci 14: 709-714.
19. Gunasekera UC, Wickramasinghe S, Wijesinghe G, Rajapakse RPVJ (2012) Gastrointestinal parasites of captive of primates in the national zoological gardens of Sri Lanka. Taprobanica 4: 37-41.
20. Nath BG, Islam S, Chakraborty A (2012) Prevalence of parasitic infection in captive non human primates of Assam State Zoo, India. Vet World 5: 614-616.

Citation: Dawet A, Yakubu DP, Butu HM (2013) Survey of Gastrointestinal Parasites of Non-Human Primates in Jos Zoological Garden. J Primatol 2: 108. doi:10.4172/2167-6801.1000108